Accurate
TECHNOLOGY INC.
Linear Digital Measuring Systems

Pro-60™

User Manual for:

Wood Moisture Meter

Part Number 701-2000-001

WARRANTY

Accurate Technology, Inc., warrants this product against defective parts and workmanship commencing from the date of original purchase. Upon notification of a defect, Accurate Technology, Inc., shall have the option to repair or replace any defective part. Such services shall be the customer's sole and exclusive remedy. Expenses incidental to repair, maintenance, or replacement under warranty, including those for labor and material, shall be borne by Accurate Technology, Inc. Freight or transportation charges to Accurate Technology, Inc., shall be paid by the customer.

Except as expressly provided in this warranty, Accurate Technology, Inc., does not make any warranties in respect to the product, either expressed or implied, including implied warranties of merchantability or fitness for a particular purpose, except as expressly provided in this agreement.

Accurate Technology, Inc., shall not be liable for any special, incidental, or consequential damages or for loss, damage or expense directly or indirectly arising from the customer's use of or inability to use the equipment either separately or in combination with other equipment, or for personal injury or loss or destruction of other property, or from any other cause.

To request repairs (either warranty qualified parts or not), contact Accurate Technology, Inc. directly by phone, fax, or e-mail. A Returned Merchandise Authorization (RMA) number is required before returning a product for repair.

Accurate Technology
270 Rutledge Rd. Rutledge Rd.
Fletcher, NC 28732
(800) 233-0580 (US and Canada)
+1 828-654-7920
+1 828-654-8824 (Fax)
customerservice@accurate-technology.com

www.proscale.com

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INTRODUCTION

Congratulations! You have purchased one of the most accurate moisture measurement instruments for wood in the world. Using patented electromagnetic wave technology designed by Wagner Electronics, this hand-held meter has been proven by universities and institutes worldwide to provide superior measurement results.

The Pro-60 meter measures the moisture content in a 38mm, (1.5 inch) wide by 63mm, (2.5 inch) long by up to 38mm, (1.5 inch) thick area of your wood. This closely approximates the full-thickness cross-section method used when performing the ASTM D 4442-92 Oven Dry lab test for determining moisture content in wood. This ASTM standard (and its international counterparts) is the standard to which all moisture meters for wood are compared for accuracy. Accurate Technology's design has been proven in many studies to provide some of the most accurate results in the industry when compared to this worldwide standard.

PRO-60 SPECIFICATIONS

Size: Length 115mm (4 9/16in) x Width 70mm (2 ¾in) x Height 27mm (1 1/16in)
Scanning Area: L 38mm (2 ½in) x W 63mm (1 ½ in) Depth: 19-38mm (¾ - 1 ½ in)
Weight: 170g (6 ounces)
Power: 9 volt alkaline or ni-cad rechargeable
Measurement Range: 5% – 30% MC scaled in 0.1% increments
Density (SG) Range: 0.30 to 0.70 SG
Operating Temperature: 0 - 44 °C (30 - 110 ° F)

OPERATIONAL INSTRUCTIONS

ON/OFF BUTTON: When the meter is off, momentarily pressing then releasing this button will cause the meter to turn ON, and briefly display the firmware version, then enter Measurement Mode.

To turn OFF the meter, depress the ON/OFF button momentarily, then release. The meter will also turn itself off automatically when not in use as described in the auto-shutdown section.

HOLD BUTTON: When the meter is in Measurement Mode, and the button is momentarily depressed, it will enter Hold Mode to allow the user to "freeze" the moisture content reading. Hold Mode is selected when the symbol **"÷"** appears in the left corner of the display.

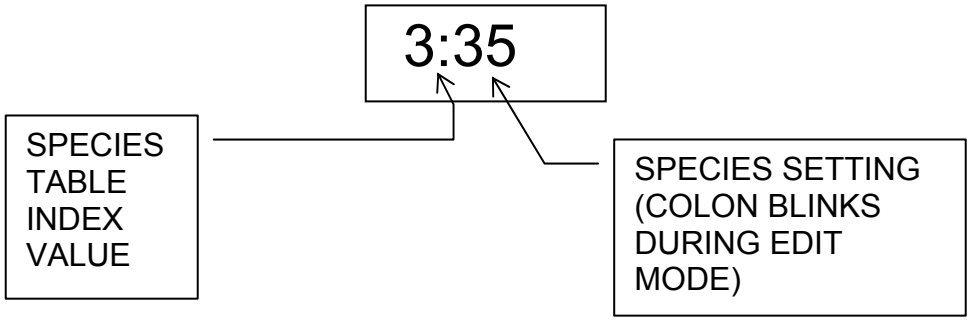
This function is ideal for keeping a moisture reading on the display when you are taking moisture readings in hard-to-reach places. The reading will be "frozen" on the display until you press and release the Hold button again.

SPECIES BUTTON: The species setting can be changed to compensate for a variety of wood species. Refer to the species table included with your meter to locate the correct species setting for your wood. If your material is not listed, refer to the "Species Corrections" portion of this manual. The values entered into the Pro-60 meter omit the decimal point, so for example the Douglas Fir value of 0.50 would be "50" when programming the Species Setting Value.

The Pro-60 can store 3 different species settings at a time, which can be selected by the Species Table Index value. Momentarily pressing the Species Button will cause the display to show the current Species Table Index (Index value 1, 2, or 3), and the species setting value (SG) for that index number.

AUTO-SHUTDOWN: The meter will automatically shutdown in 60 seconds anytime the meter moisture content reading has not changed by more than 2%, and no meter buttons have been pressed. The shutdown timer will reset anytime the meter reading changes or a button has been pressed.

LOW BATTERY INDICATOR: If the meter is ON, and battery voltage is low, the LO BAT indicator will be shown on the left side of the display. When the LO BAT indicator is on, you must replace the battery or the meter may not function correctly. If the battery needs to be replaced, use either a 9-volt alkaline or a ni-cad rechargeable. Be sure to observe proper battery polarity.



Example: Species Table Index Value= 3, Species setting = 35

Each time the Species Button is pressed, it will increment the Species Table Index value and show the current setting for that index. The index value will increment to 3 and wrap back to 1.

To exit Species Select Mode, momentarily press and then release the HOLD button.

PROGRAMMING

To select a new Species Table Index, press and release the Species Button. The current species index and the value will be displayed. Press the Species Button again to toggle through the 3 available species indexes.

To change the species setting value of the species index being displayed from the species index view display, press and hold the Species Button and the Hold Button simultaneously for at least 3 seconds, then release. The meter is now in the Edit Mode and the colon symbol **":"** will begin blinking.

In Edit Mode, the Species Button increments the Species Setting value. Press the Species Button and release it in less than 1 second, to increment the species value by 01. If you hold down the Species Button, it will increment by 10 each 1 second. The value will go up to 70, then will wrap around to 30 and continue incrementing.

When you have reached the desired Species Setting value, press and release the Hold Button. This will save the Species Setting value in non-volatile memory and the meter will go into Measurement Mode.

Your commonly used species setting index numbers can be written on the meter overlay decal in the space provided using a pencil or non-permanent marker, and erased with a swab dipped in isopropyl alcohol. Avoid using a permanent marker because staining of the decal may occur.

TAKING MEASUREMENTS

In order to take correct moisture content measurements, ensure that the meter's specific gravity (species) setting is the right one for your species of wood as listed in the Species Adjustment Table*.

Be sure to press down firmly on the meter with approximately 1500g (3 pounds) of force to ensure good sensor plate contact with the wood surface. This is especially important on rough-sawn lumber. Do not take readings where there is a noticeable defect or knot in the lumber. Be careful not to press down only on the lower end of the meter as this can cause to meter to rock back from the raised sensor plate surface.

If there is visible surface moisture or water, wipe off any excess, and let the surface of the wood dry-out for a couple of minutes, then take the reading. If possible, turn the board over and measure the other side. If the thickness of the piece is greater than 1.5 inches, it is a good idea to take measurements on both sides.

If the lumber thickness is less than the scan depth of the meter, an air gap of at least one inch needs to be maintained underneath the wood to prevent erroneous high readings. Ensure that there is nothing (including your hand) under the material you are measuring, especially any metal. The actual moisture sensing area is a 38mm (1.5 inch) x 63mm (2.5 inch) rectangle on the meter's backside (opposite side of the display and keypad). In order to take a valid measurement, this sensing area must be completely covered with the wood or other material you are measuring. If the sensing area is not completely covered, your moisture reading will be inaccurate.

* Additional meter corrections may be necessary if you are measuring Raft Wood (salt water permeated), or lumber treated with Copper, Chrome, Arsenic (CCA), or Ammonical, Copper, Quantenary (ACQ). Contact Accurate Technology for further information for these applications.

METER STORAGE

For a long service life, it is important to store your meter properly. Avoid excessively hot or cold locations, and keep the meter in the case provided. Do not store the meter in an area with excessive electro-magnetic interference, such as near an electric motor. Remove the battery if you plan an extended storage time.

SPECIES CORRECTIONS

The dry specific gravity (density) values for a species are based on the best, current world data, and are used to determine the species correction factor within the meter. The values provide average density values for the species. A coefficient of variation (COV) of about 10% describes the variability inherent in many common domestic (US) species.

If the specific gravity of your lumber is not listed in the Species Settings Tables provided or you are dealing with an unknown species, the value may be determined by referring to the "Determining the Specific Gravity" section of this manual. Additional resources are: the Forest Products Lab at http://www.fpl.fs.fed.us/ and the Wood Handbook at: http://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr113/fplgtr113.htm

The Pro-60 meter can be used to measure non-wood materials if the density is similar to wood products. Non-wood species can be measured by using the meter reading as a relative value such as in “go/no-go” applications, or when determining if one measurement area contains more moisture than another, i.e. measurements that do not require a high absolute accuracy. SG formulas can’t be applied to non-solid wood species due to the presence of glues and resins, which cause a non-linear moisture content curve. If greater accuracy is required, the ASTM oven-dry procedure can be used to determine a meter correction value for non-solid woods.

Commentary on Species Adjustment

In 1992, a study was conducted at the Forest Research Laboratory of Oregon State University on species correction for the Wagner Hand-Held Moisture Meters. The species tested were Douglas Fir, Lodgepole Pine, Western Red Cedar, Western Hemlock, White Fir, Western Larch, Engelmann Spruce, and White Oak. Three to four 40-piece samples of each species were tested. Specific gravity was found to be the primary factor on species adjustment. A species equation as a function of specific gravity and the meter reading was obtained using multiple-regression technique (R-square = 0.95) as follows:

AF = 8.77 + (0.25 * MM) – (15.86 * SG) – (0.62 * SG * MM) in which

AF = Species Adjustment

MM = Meter Reading

SG = Specific Gravity in oven dry weight and 12% moisture-content volume basis.

The species adjustments provide the adjusted moisture measurements that are based on the species adjustment determined using the species adjustment equation, with rounding to the nearest 0.5.

Wood is not a uniform material. Specific gravity of solid-sawn lumber varies within the piece and among pieces. In the OSU study, the average specific gravity for each species differed from the individual sample by plus or minus 1% to plus or minus 8%. For general applications, average specific gravity values can be found in the Wood Handbook (USDA Agriculture Handbook No. 72, 1999). Except for one species for which the experimental value is 7% higher, the species' overall average specific gravity values obtained in the OSU study are comparable with those in the Wood Handbook. The exception may be caused by unknown biases in the sampling scheme. The Wood Handbook values are used in the tables, except for the imported species, unless otherwise noted.

Species adjustment can be determined for lumber sorted, or otherwise known, to have specific gravity different from the species' average. One example is lumber graded under the Dense rules. If the specific gravity of a lumber sample is known, species adjustment can be determined by the species adjustment equation.

The species adjustment equation provides a way to expand the use of the Pro-60 Hand-Held Moisture Meters for lumber of any species groups having similar species-specific gravity values. One example is Hem-Fir. For a species group, one way to determine the species adjustment is by the use of a weighted average of the individual species' average specific gravity values. The weighing procedure used in the ASTM D2555 by standing timber volume can be used. Species adjustment is not recommended for any species group having a broad range of species-specific gravity values. There are no recognized limits on species group species adjustment. Species adjustment for species groups should be used with knowledge on the variability on species involved and the affect of it on species adjustment. If the species mix in the lumber production of a species group is controlled or known to have specific gravity different from that used for the species group, a better estimation of species adjustment can be determined using the known specific gravity in the above species correction equation.

DETERMINING SPECIFIC GRAVITY

Determining the Adjustment Factor for an Unknown Species

The Specific Gravity Chart is based on specific gravity of solid wood is provided on a separate sheet included with the meter. If you don't know the species of the wood you are using, or the specific gravity differs from the handbook because of a different growing region, use the following procedure.

1. Select a sample of wood that is approximately 12% moisture content, with all edges being true. Carefully measure the dimensions of the sample using a caliper. You will need the length, width, and thickness.

2. Convert these measurements to feet.

3. Carefully measure the weight of the sample.

4. Convert the weight to pounds.

5. Calculate specific gravity.

Example:

Length = 10 in. 10 in. / 12 in. = 0.833 ft.

Width = 7.5 in. 7.5 in. / 12 in. = 0.625 ft.

Thickness = 1.5 in. 1.5 in. / 12 in. = 0.125 ft.

Volume = L x W x T 0.833 x 0.625 x 0.125 = 0.065 cu. ft.

Weight = 20 oz. 20 oz. / 16 oz. = 1.25 lb.

Specific Gravity:

(Weight / Volume) / Specific Gravity of water

(1.25 lb. / 0.065 cu. ft.) / 62.34 lb. / cu. ft. = 0.31

In order to ensure that the value obtained for the specific gravity is statistically significant, a number of pieces must be measured and the average determined. Use this value of specific gravity for the species adjustment in the meter.

METER CALIBRATION

The meter has been calibrated at the factory and should not require re-calibration. If you need to have the calibration verified, please contact Accurate Technology to purchase a calibration verification block. Should the meter need to have a calibration adjustment, it will need to be returned to Accurate Technology. See WARRANTY for return information.

SPECIES SPECIFIC GRAVITY CHART

Note: The SG values are entered as a whole number for the species setting value.

SG	U.S. Hardwood Species	SG	U.S. Softwood Species	SG	Imported Species
0.41	Alder, Red	0.46	Baldcypress	0.69	Afrormosia
0.61	Apple	0.44	Cedar, Alaska	0.64	Andiroba
0.49	Ash, Black	0.32	Cedar, Atlantic white	0.54	Anegre
0.58	Ash, Blue	0.47	Cedar, Eastern red cedar	0.55	Avodire
0.56	Ash, Green	0.37	Cedar, Incense	0.62	Banak (Cuangare)
0.55	Ash, Oregon	0.31	Cedar, Northern white	0.77	Benge (Ehie, Bubinga)
0.55	Ash, Red	0.43	Cedar, Port Orford	0.61	Caribbean pine
0.60	Ash, White	0.32	Cedar, Western red cedar	0.44	Cativo
0.39	Aspen, Bigtooth	0.44	Cedar, Yellow	0.91	Courbaril (Jatoba)
0.38	Aspen, Quaking	0.50	Douglas fir	0.51	Cypress
0.37	Basswood, American	0.35	Fir, Balsam	0.82	Degame
0.64	Beech, American	0.38	Fir, California red	0.58	Determa
0.55	Birch, Paper	0.37	Fir, Grand	0.70	Ebony, East Indian
0.65	Birch, Sweet	0.39	Fir, Noble	0.50	Gmelina
0.55	Birch, White	0.43	Fir, Pacific silver	0.38	Hura
0.62	Birch, Yellow	0.32	Fir, Subalpine	1.00	Ipe
0.38	Butternut	0.39	Fir, White	0.70	Iroko
0.50	Cherry, Black	0.40	Hemlock, Eastern	0.80	Jarrah
0.43	Chestnut, American	0.45	Hemlock, Mountain	0.46	Jelutong
0.34	Cottonwood, Balsam poplar	0.45	Hemlock, Western	0.76	Kapur
0.35	Cottonwood, Black	0.52	Larch, Western	0.84	Kempas
0.40	Cottonwood, Eastern	0.35	Pine, Eastern white	0.64	Keruing (Apitong)
0.64	Dogwood, Flowering	0.43	Pine, Jack	0.67	Koa
0.50	Elm, American	0.51	Pine, Loblolly	0.67	Lauan, Dark Red
0.63	Elm, Rock	0.41	Pine, Lodgepole	0.50	Lauan, White (Light Red Meranti)
0.53	Elm, Slippery	0.59	Pine, Longleaf	0.45	Limba
0.53	Hackberry	0.52	Pine, Pitch	0.61	Mahogany, African
0.66	Hickory (Pecan), Bitternut	0.56	Pine, Pond	0.93	Mahogany, Santos
0.60	Hickory (Pecan), Nutmeg	0.40	Pine, Ponderosa	0.59	Mahogany, True
0.66	Hickory, Pecan	0.46	Pine, Red	0.68	Manni
0.62	Hickory (Pecan), Water	0.48	Pine, Sand	0.80	Merbau
0.72	Hickory (True), Mockernut	0.51	Pine, Shortleaf	0.65	Mersawa
0.75	Hickory (True), Pignut	0.59	Pine, Slash	0.63	Mueri (Cherry)
0.72	Hickory (True), Shagbark	0.44	Pine, Spruce	0.38	Obeche
0.69	Hickory (True), Shellbark	0.36	Pine, Sugar	0.66	Ocote pine
0.50	Holly, American	0.48	Pine, Virginia	0.44	Okoume
0.63	Hophornbeam, Eastern	0.38	Pine, Western white	0.73	Opepe
0.51	Laurel, California	0.40	Redwood, Old-growth	0.54	Parana pine
0.69	Locust, Black	0.35	Redwood, Young-growth	0.63	Peroba de campos
0.58	Madrone, Pacific	0.42	Spruce, Black	0.75	Peroba rosa

(Continued on next page)

SG	U.S. Hardwood Species
0.50	Magnolia, Southern
0.48	Maple, Bigleaf
0.57	Maple, Black
0.66	Maple, Hard
0.54	Maple, Red
0.47	Maple, Silver
0.51	Maple, Soft
0.63	Maple, Sugar
0.61	Oak (Red), Black
0.51	Oak, California black
0.68	Oak (Red), Cherrybark
0.63	Oak (Red), Laurel
0.63	Oak (Red), Northern red
0.63	Oak (Red), Pin
0.67	Oak (Red), Scarlet
0.59	Oak (Red), Southern red
0.63	Oak (Red), Water
0.69	Oak (Red), Willow
0.64	Oak (Red), (1)
0.64	Oak (White), Bur
0.66	Oak (White), Chestnut
0.63	Oak (White), Overcup
0.67	Oak (White), Post
0.67	Oak (White), Swamp chestnut
0.72	Oak (White), Swamp white
0.66	Oak, White
0.64	Persimmon, Common
0.46	Sassafras
0.52	Sweetgum
0.49	Sycamore, American
0.58	Tanoak
0.50	Tupelo, Black
0.50	Tupelo, Water
0.55	Walnut, Black
0.39	Willow, Black
0.42	Yellow-poplar

SG	U.S. Softwood Species
0.35	Spruce, Engelmann
0.40	Spruce, Red
0.40	Spruce, Sitka
0.36	Spruce, White
0.51	SYP (Southern Yellow Pine)
0.53	Tamarack

SG	Imported Species
0.45	Primavera
0.80	Purpleheart
0.48	Radiata pine
0.65	Ramin
0.64	Roble (Quercus)
0.85	Rosewood, Brazilian (Jacaranda)
0.85	Rosewood, Indian
0.61	Santa Maria
0.62	Sapele
0.41	Spanish Cedar
0.59	Teak
0.67	Yew

Plywood and OSB
Spec. Gravity: Plywood and OSB:
0.57 . . . .Southern Yellow Pine CDX Plywood (2).
0.57 . . . . . Douglas Fir CDX Plywood (2).
0.70 . . . . . .Southern Yellow Pine OSB (2).
0.70 . . . . . Douglas Fir OSB (2).

Specific Gravity Correction Value Sources
(1). This SG correction value was developed by Wagner Electronic Products, Inc.
(2). This SG correction value was developed by Wagner Electronic Products, Inc. These values are based on our research and have been developed to give users a general correction factor for plywoods & OSB. Please keep in mind that plywood & OSB manufacturing processes can differ slightly and some plywood and OSB of the same species may vary slightly.

PRODUCT REGISTRATION

Fill out for your records and
FAX to Accurate Technology @ (+1) 828.654.8824 or
Register on line at www.proscale.com

Name _____

E-Mail _____

Company _____

Address _____

Address _____

City _____

State/Region _____

Zip/Postal Code _____

Country _____

Purchased From: _____

Purchased When: _____

Pro-60 Serial Number: